

Window pressure test instrumentation

☞ Procedures

☞ Measurement of the deflection

- ☞ Projector & camera

- ☞ Laser

- ☞ Capacitive sensor

☞ Measurement of the strain

- ☞ Mold to reinforce the window during the gages installation

- ☞ Practice mold for the installation of the strain gages

☞ DAQ

- ☞ Signal conditioner: amplifier and excitation stable =>5B system

- ☞ DMM and multiplexer

Procedures

Goal of the pressure test:

Validation of the numerical analysis for a 0.13 mm thick absorber window for the process of acceptance of the manufactured window.

Simulate the MUCOOL condition regarding pressure (Hydraulic test @RT)

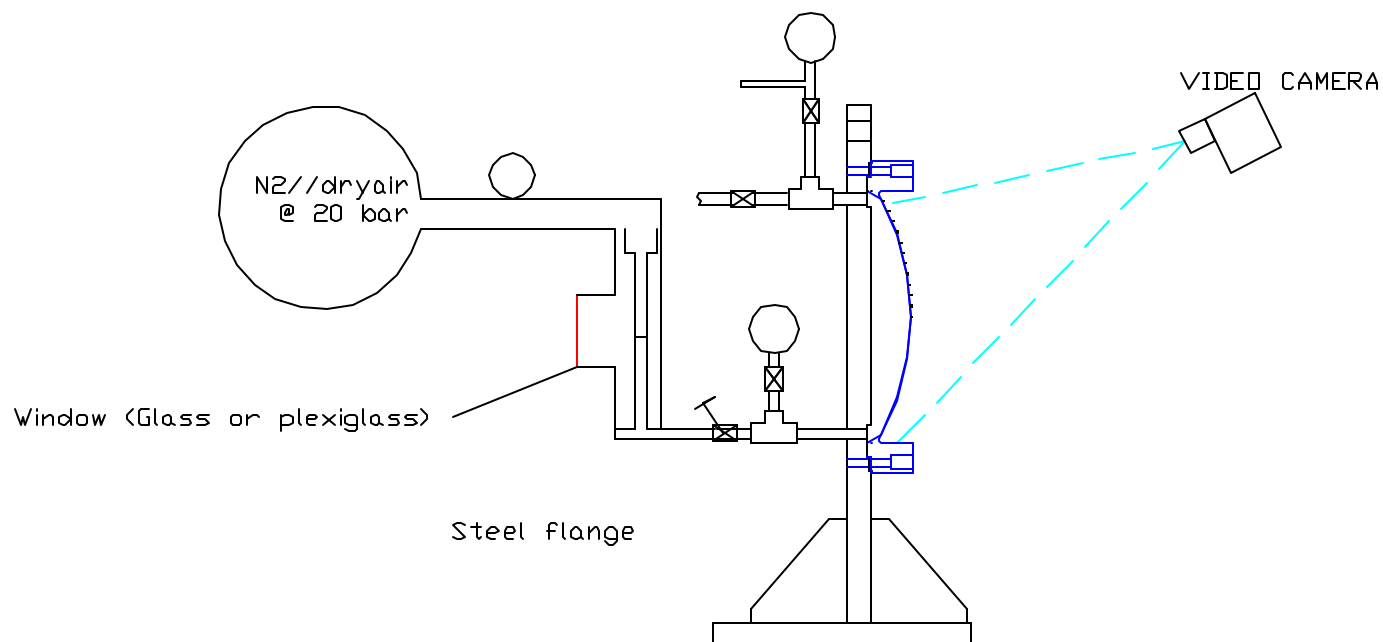
Procedure:

Loads: Pressure of water applied on the concave side of the window

Control: Pressure transducer and Regulation of the pressure

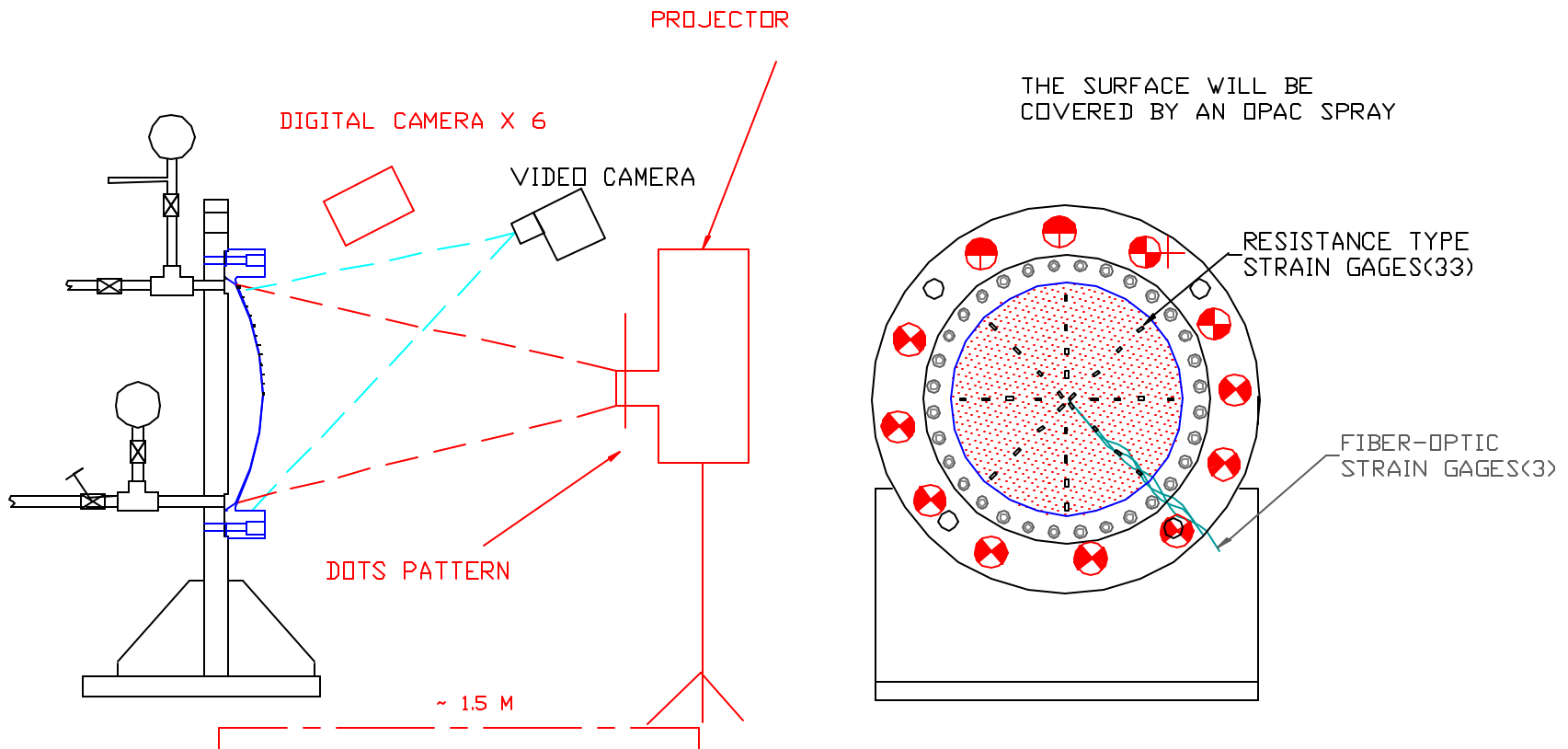
Measurement: Strain gages & Projector/Camera

Procedures



WINDOW PRESSURE TEST SETUP - PRESSURE REGULATION

Measurement of the deflection



WINDOW PRESSURE TEST SETUP W/ ITS INSTRUMENTATION

Measurement of the strain

Strain gages - Specification:

Construction: Fully encapsulated grid with exposed copper-coated tabs

Foil Alloy: Constantan

Carrier Matrix: Polyimide

Nominal gage thickness: 1 mil

Strain limits: +/-3%

====> Estimation of the influence of the strain gages installation over the mechanical property of the window.

Max. strain to measure:

Al 6061 T6 (E= 7.104 @RT, δ =262 Mpa)

δ

$\epsilon = \frac{\delta}{E} \sim 3700 \mu \epsilon$

E

Measurement of the strain

Goal: Strain gages need to be assembled on the 0.13 mm thick Aluminum window in order to record the behavior of the absorber window while it is pressurized to break.

Materials:

- 33 strain gages: model EA-03-250BF-350, EA-13-250RD-350, EA-06-125RD-350
- M-Bonding
- twisted copper wires
- 11 connectors

Location of gages: On the convex side of the window, along the four concentric circles built as in the attached drawing, plus one gage on the middle.

How:

- Clean surface with adapted solvent.
- Locate the reinforcing mold on the concave side
- Applied gages on the aluminum window with their standard bonding adhesive.
- Gages should be installed so that the lead side is oriented toward the window flange.
- Gage leads should be bended in order to avoid any contact with the aluminum surface.
- Four copper wires (4 meters long) should be soldered to the two leads and routed toward the window flange: white/black and red/green
- Tape should only be used to protect wires on the window flange - no tape on the thin part of the window.
- The extremity of the wires should be assembled to connectors (three gages per connector).

Measurement of the strain

Difficulties foresee:

- .A pressure must be applied to the strain gages and transfer to the thin layer in order to cure the bonding adhesive and release from air inbetween the gage and the window.
- .Convex surface to assemble the gages.

Solution proposed:

Fill partially the concave surface with an epoxy that will stiffen the aluminum window and permit to assemble the strain gages.

==> durometry test = 80

Test at the material lab to find the right technic :

Preparation of a concave glass-fiber and epoxy mold => to simulate the shape of the window

Fill it with epoxy,

- w/ and w/o mold release,
- w/ and w/o mylar (1/2mil of 1 mil), w/ hande wrap paper
- w/ and w/o aluminum filler

DAQ

Instrumentation read-out:

1 Pressure Transducer: (0-5V)

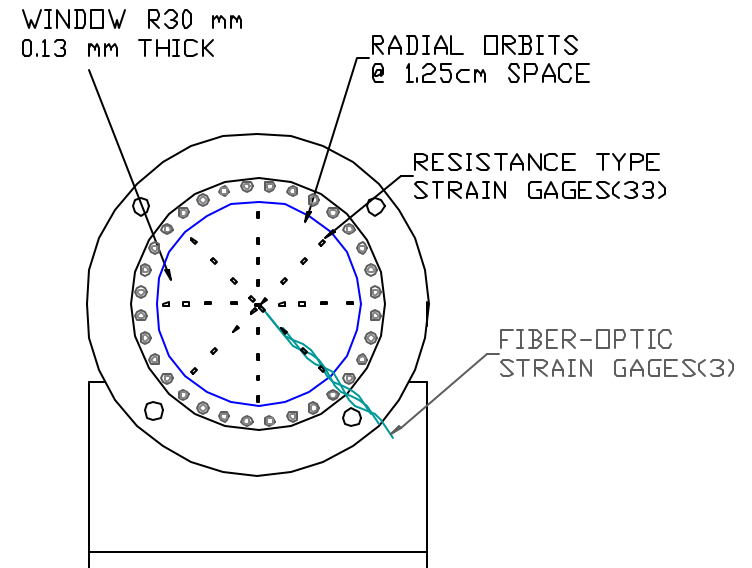
33 strain gages: (0-1 V)

3 fiber optic strain gages (signal conditioner : Analog
 output: ± 10 V)

DAQ:

35 independant signal conditioners

1 DMM with 2 multiplexer cards



WINDOW PRESSURE TEST SETUP - DAQ